PROCESS FOR EVALUATING THE LENGTH OF TRANSIENTS DUE TO IMPACTS USING TIME-DOMAIN SAMPLES

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I. INTRODUCTION

On this work, we follow a methodology for estimating the time-duration of a transient due to the collision between two rigid bodies. This type of measurements is interesting as the main factors that determine the length of a collision are objects' physical characteristics (type of material, mass, geometry) and the forces involved during the impact (impacting velocity, contact surface, angle of impact) [1]. Under well-controlled conditions, knowing the duration of an impact can help to extract information from the objects.

If the impacting force is small enough to ensure that there are no plastic deformations, then it is possible to consider an elastic collision, where the forces acting on the objects approximate the linear behavior given by the Hooke's law, $F = kx$, where x is the displacement and k is the spring constant [2]. In addition to this consideration, we assume that two very rigid materials take part in the collision: one of them acts as the "impactor" and the other as a "test" sample.

Figure 1a shows the system used to test this methodology. The impactor is a hammer with an aluminum spherical tip, and it taps the flat surface of the test sample, which is a steel cylinder. Due to their geometries, during impact both objects are in contact at one single point.
Figure 2 shows the characteristic response of the hammer-cylinder system due to a transient pulse input. It is an oscillating damped movement, as the one obtained with a second order system, as shown in figure 1b. In figure 2 we can find that the response can be divided in two parts, named A and B. Part A is known as the transient response, and it is related to both bodies acting together during contact time; part B is the steady-state response, where the test object oscillates at its natural frequency.

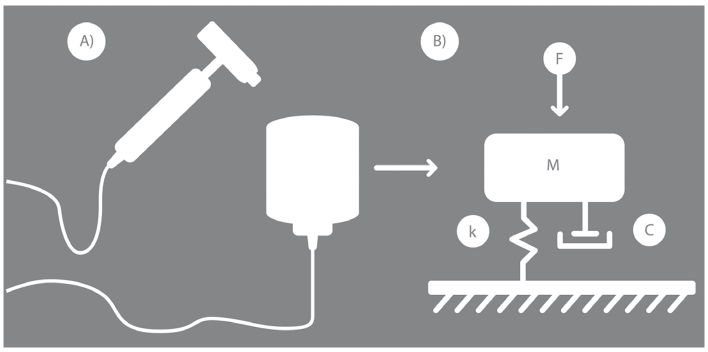

Figure 1. System set-up. A) Physical system. B)System model.

II. MEASURING PROCEDURE

The procedure we are following will lead to the calculation of the fundamental frequency of the first cycle found in the transient response. This measurement needs three equally spaced time-domain samples, as shown in equation (1) [3]:

$$w = \frac{1}{Ts}\left(\arccos \frac{U_{n-d} + U_{n+d}}{2 \cdot U_n}\right)$$

where, w is the frequency in radians, Ts is the sampling period, n is any sample along the signal and d is the distance of the central sample to the other two, forming an equidistant group.

Because the signal under analysis is not perfectly sinusoidal, we repeated the calculations using seven different groups of samples spread along the signal and then average the results. Figure 3 shows how we choose the samples. First, we looked for the maximum pick, where we located the central sample of the first group.Then, the rest six central samples were located at the 15%, 10% and 8% of the maximum pick, to both sides. The parameter d was set with a suitable value in order to have the side-samples at both sides of the lobe.

III. RESULTS AND CONCLUSIONS

Experimental results are shown in table 1, where it is possible to observe the corresponding frequency for each group of samples, the mean frequency value and the standard deviation. It is interesting to notice that the transient response we observe in figure 2 corresponds only to a half-cycle of an approximately sinusoidal wave. In order to obtain the time duration of the transient, we need to divide the period we obtain from the measured frequency by two, which is also displayed in the last row of table 1.

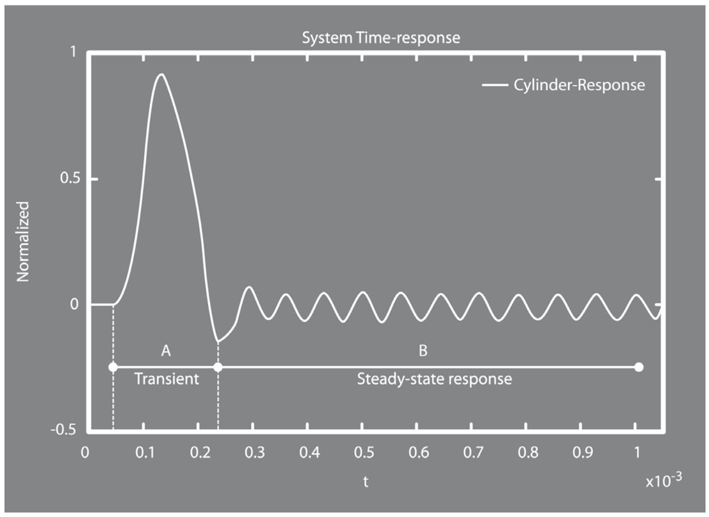

Figure 2. System time response. A) Transient response. B) Steady-state response.

TABLE 1

Fn1	4089.87 [Hz]
Fn2	4076.71 [Hz]
Fn3	3992.20 [Hz]
Fn4	3875.78 [Hz]
Fn5	3723.94 [Hz]
Fn6	3515.43 [Hz]
Fn7	3067.85 [Hz]

Average	3763.11 [Hz]
St. Dev.	368.91 [Hz]
Time Length	132.87 [µS]

This method is an alternative to the frequency domain analysis, where the main advantages are that only few time-domain samples are required to estimate the fundamental frequency of the transient response and a reduced calculation process.

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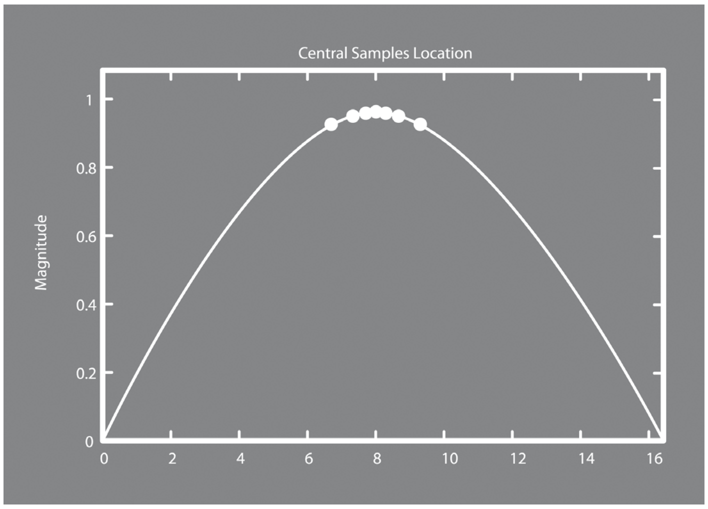

Figure 3. Position of central samples.

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AN INTRANET FOR ISO 9001:2000 STANDARD MANAGEMENT

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Abstract—*The aim of this project was to develop a dynamic environment in order to manage and control all the aspects related to the standard ISO 9001:2000. It's based on an Intranet that uses an associated database to store all the relevant data. The company staff is able to access the Intranet by entering their username and password (which are previously encrypted to protect their personal information) and they can create, modify or delete (depending on their profile) different kinds of data stored in the system. There are many useful functions, such as making specific queries amongst the data, monitoring the status of the different projects or performing surveys to evaluate the employees' and student's satisfaction. Although the system is currently finished and active, new functionalities are constantly being developed and added as they are required.*

Keywords— ISO 9001:2000; dynamic environment; Intranet; Web Languages (PHP, JavaScript, CSS); MySQL database; user profile; data queries.

I. INTRODUCTION

The ISO 9001:2000 is part of the ISO group of standards, and its requirements are meant to improve the company's Quality Control system, in order to satisfy the clients' needs and expectations. Having an ISO 9001 certificate gives the client a guarantee on the quality of the services that the company has to offer, so having a useful environment to manage the different aspects of this Quality Control system turns out to be a very important matter.

The SARTI group obtained the ISO 9001 certificate in the year 2004, and uses a software-based system to carry out the management. Although it was pretty good at the beginning, it soon turned to be a very static application, and the need of having more functionalities ended up with the project of developing a system of our own.

The decision of developing an Intranet for this purpose was taken based on the advantages against a regular application. The most important is that there is no need for any specific software to be able to enter the system, just an internet navigator. This makes the system much more accessible, because the users can enter the Intranet from any computer which is connected to the Internet. It will be easier to control the access to the system too, as it will only consist on developing a login interface and giving each user a username and password. It also turns the design tasks more flexible, being able to show the data in many different ways.

At this time, the Intranet has all the sections needed in order to manage every part of the ISO 9001 requirements. Despite that, it is constantly being improved with new kinds of queries, views or links between data, in order to make its use faster and more efficient.

II. DESIGN

One of the most important features that had to be improved was the interconnection between data. The user had to be able to jump between related elements, such as a client and its related projects, or the students that belong to a course, etc. Due to this fact, the main structure of the database has been designed in order to satisfy that requirement. All the tables that store important elements have an 'id' field that identifies them, and the information of this field will be used in every other table that needs to be associated with that element, by generating an external key.

The other main requirement was to add more useful functionalities to the system, such as implementing a way to monitor the status of projects, services, purchases, etc., to be able to add new versions of this elements and, at the same time, keep a history of the old ones, to relate the different incidences that may occur to the elements that produce them, etc. The database has been designed considering all of these requirements, in order to make the system much more dynamic than before.

Besides from the data treatment, there was another huge aspect to bear in mind in terms of design, which was the creation of profiles to be assigned to the users of the Intranet. Depending of this profile, they will be classified as:

-Administrators: can read, create and modify all kinds of data, including the information about users.